?ORTS OF THE SWEDISH DEEP-SEA EXPEDITION. VOL. II. ZOOLOGY. NO. 12

HOLOTHURIOIDEA

BY

F. JENSENIUS MADSEN
ZOOLOGICAL MUSEUM, COPENHAGEN

othurians (or fragments of such) were cted in nine of the trawlings made by the dish Deep-Sea Expedition in the Atlantic 948. These animals were thus present in ly all the successful hauls. At least nine rent bottom-dwelling deep-sea species are esented. They belong to three different rs: 1) the Apoda, with the Synaptid *ankyra brychia* (Verrill), 2) the Aspidochirota, also with one species, the Synaptid *Mesothuria candelabri* Hérouard, and he Elasipoda to which all the remaining species belong, viz. of the family idiidae: *Peniagone lugubris* Théel, *P. porus* Perrier, *P. nybelini*[1]) n. sp., *Scotoanassa slucida* Hérouard, and an unidentifiable cies of *Peniagone* or perhaps *Scotoanassa* y represented by some juvenile specimens); of the family Psychropotidae: *Benthodytes ca* Théel, *Euphronides kerhervei* (Hérouard), *Psychropotes* aff. *minutus* Koehler & Vaney. f the identifiable species, therefore, one is sidered new to science, and one species, *chropotes minutus*, was hitherto known only n the type-locality in the Indian Ocean, reas all the other species were recorded viously from the Atlantic deep-sea, three them, however, only being known from the elocalities.

Protankyra brychia (Verrill 1885)
Fig. 1.

apta brychia Verrill 1885 p. 539.
apta abyssicola Théel 1886 a pp. 14—18, l. 1 11.

[1]) Named after Dr. O. Nybelin, the leader of the biological investigations of the Swedish Deep-Sea Expedition.

Synapta sp. Théel 1886 b p. 20.
Protankyra abyssicola R. Perrier 1902 pp. 538—540.
Protankyra abyssicola H. L. Clark 1908 pp. 25, 105, pl. 4 8—11; 1924 pp. 496—497 (pars).
Protankyra abyssicola Hérouard 1923 p. 140.
Protankyra abyssicola Heding & Ludwig 1935 pp. 146—150 figs. 12—13.
Protankyra brychia H. L. Clark 1908 pp. 25, 105, pl. 4 12—14.
Protankyra brychia Deichmann 1930 p. 209; 1940 pp. 229—230, pl. 41 1—3.
? *Protankyra abyssicola* var. *pacifica* Ludwig 1894 pp. 174—178, pl. 18 13—19.
? *Protankyra pacifica* Ludwig, in Heding & Ludwig 1935, p. 149.
? *Protankyra abyssicola* H. L. Clark 1913 pp. 227—228; 1920 pp. 124—125; 1924 pp. 496—497, pls. 11 6—7, 12 1.

Material: St. 387 (Haul No. 13), N 40° 33′ W 35° 24′—N 40° 34′ W 35° 52′, Sept. 7th 1948; depth 4,540—4,600 m: 5 specimens and 2 fragments.

The largest of the intact specimens measures 37 mm in length. The two fragments, the one a fore part and the other a hind part, originate from considerably larger specimens, or possibly both from the same individual, which in that case was at least 70 mm long. The smallest specimen is only 9 mm in length. All the specimens are much contracted.

The colour of the preserved specimens varies from whitish to a very pale pink, sometimes

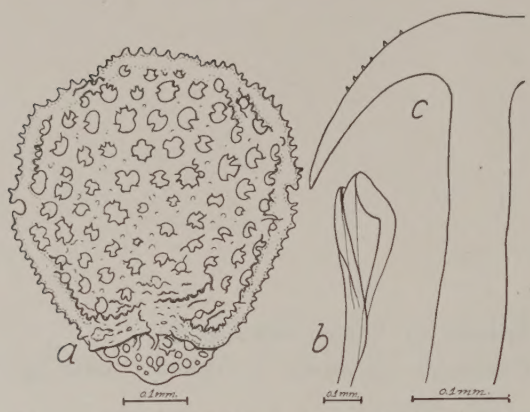


Fig. 1. *Protankyra brychia*. *a*. A fully developed anchor plate, with closed margin, from a specimen about 70 mm long. *b*. Ciliated funnel from a specimen measuring about 30 mm. *c*. Part of an anchor from the specimen about 70 mm long.

with fairly large ochrous areas. The tentacles (twelve, each with two pairs of digits) are whitish or slightly purplish. The oral disc is violet.

Two specimens which were dissected had four and six polian vesicles respectively. Ciliated funnels were found in a longitudinal series in the fore part of the left dorsal interradius. They are much higher than broad and thus differ from those figured by LUDWIG (1894 pl. 18 18—19) for his *P. abyssicola* var. *pacifica*. Their preservation does not allow a closer description but one is sketched in Fig. 1 *b*.

The specimens agree fairly well with the description of *abyssicola* given by LUDWIG & HEDING (1935) for the specimens collected by the Valdivia off West Africa; but the plates, with 50—70 holes, are not quite so large as stated for that material. A fully formed anchor plate is figured here (Fig. 1 *a*) since the illustrations given by LUDWIG & HEDING, op. cit., and by DEICHMANN (1940) only show plates in which the circumference is not yet closed, they apparently still adding holes here. Such plates are, however, the most commonly ocurring ones in the present material also. The spines, about six in number, present on each of the anchor flukes are very small and only clearly discernible at a fairly high magnification; both CLARK's figure (1908 pl. 4 12) LUDWIG & HEDING's text-fig. 12 3 were parently drawn at a too low magnificatio showing their real appearance, and a fi of an anchor fluke is therefore also incl (Fig. 1 *c*).

The species to which these specimens referred was described by VERRILL in (as *Synapta brychia*) on a specimen fro the East Coast of N. America (Cape Hatt at a depth of 1,715 m. DEICHMANN in added two new localities in the same area New York, 2,021 m, and off Florida, d unrecorded, and stated that THÉEL's *Syn sp.* (1886 b) from off New York, 2,549 m, also a *P. brychia*. DEICHMANN is further o opinion that THÉEL's *S. abyssicola* also bel to *P. brychia*.

Synapta abyssicola was described by Th (1886 a) on a fragmentary specimen fro tropical West Africa, 4,298 m. R. PER (1902) added a new locality in the same depth: 3,200 m. HÉROUARD (1923) rec the species from off the Bay of Biscay at m; and LUDWIG & HEDING (1935) added further localities off tropical West Afric depths of 2,225 to 4,990 m.

LUDWIG in 1894 described a numb Synaptids from off the Gulf of Panama, d 3,058 to 3,241 m, as a new variety of *a cola*: var. *pacifica*; but later he considere material to be a distinct species (LUDW HEDING, op. cit. p. 149).

LUDWIG & HEDING thus reckon with different deep-sea species of *Protankyra* a Pacific *P. pacifica*, an East Atlanti *abyssicola*, and a West Atlantic *P. bry* Consequently, they also expect the Syn recorded by CLARK (1908 p. 105) from the of Mexico, 2,259 m, under the nam *abyssicola* to be a *P. brychia*.

H. L. CLARK in 1908 in the same distinguished between *brychia* and *abys* and further stated that the var. *pacifi* which he had re-examined the types,

ed to full specific rank. In 1913, 1920, 924 CLARK recorded, however, a number ecimens from the Pacific, off America Monterey in the north to Peru in the , 869 to 4,755 m, under the name *cola*, since these specimens had anchor with fine thorns; and in his paper of 1913 apparently is not sure whether *pacifica* e maintained, as he stated formerly.

ICHMANN, as has been said above, regards *a* and *abyssicola* as synonymous, but s that *pacifica* should be maintained as inct species.

e examination of the present specimens confirms the latter opinion. The identity IÉELS's *abyssicola* with VERRILL's *brychia* bly cannot be questioned, while *pacifica*, difference here recorded in the appearance e ciliated funnels holds good, must be re- d at least as a distinct subspecies and ps be given specific rank.

stribution: *Protankyra brychia* is bly distributed throughoutth e deep-sea of the Atlantic, where it has hitherto recorded from several localities between and 16° S (cf. above). Vertical range: to 4,990 m.

e related *P. pacifica* is hitherto recorded from the Eastern Pacific, depths: 869 755 m.

esothuria candelabri Hérouard 1923

OUARD 1923 pp. 17—19, pl. 1 1—10.
M. (*Allantis*) *candelabri* HEDING 1940 pp. 1—335, Fig. 3 (= *M. cathedralis* Heding 40, vide HEDING 1942 p. 9).

erial: St. 387 (Haul No. 13), N 40° 33′ 35° 24′—N 40° 34′ W 35° 52′, Sept. 7th 48; depth 4,540—4,600 m: 1 specimen.

e specimen in its present contracted state ures about 75 mm in length and about 35 in breadth. Its shape is oblong ovoid. There are no appendages. The colour is now whitish grey and was apparently the same when the specimen was captured. The calcareous deposits agree with those of the type, i. e. they are of a delicate appearance, the disk having mostly only the eight primary holes, and with a three- or four-armed spire. More rarely the disk has also an outer ring of secondary holes. More robust deposits with a somewhat larger disk with smaller and more numerous holes (cf. HÉROUARD's fig. 7 on pl. 1) occur scatteredly in the deeper layer of the integument.

Distribution: Apart from the above locality, West of the Azores, *Mesothuria candelabri* is only known from the type-locality in the Bay of Biscay, 45° 07′ N, 7° 06′ W. Vertical range: about 4,550 to 4,870 m.

Peniagone lugubris Théel 1882

Fig. 2—3.

THÉEL 1882 pp. 44—45, pl. 10 1.

Material: St. 329 (Haul No. 3), N 09° 38′ W 26° 20′—N 09° 50′ W 26° 30′, July 3rd 1948; depth 5,610—5,600 m: 5 specimens and some fragments.

These specimens are all much contracted and distorted. It is difficult therefore to judge of their appearance when alive. They range in size of main body from about 20 mm to 35—40 mm. The largest specimen is the best preserved and a somewhat reconstructed sketch of this specimen is given in Fig. 2 *a—b*. The present appearance of two of the other specimens is sketched in Fig. 2 *c—d*.

The largest specimen is a flattened oval. The posterior part of the body bears on either side seven papillae, the most anterior pair placed ventrally (owing to the strong contraction?), the other ones being lateral, the five hindmost pairs forming a kind of brim. Be-

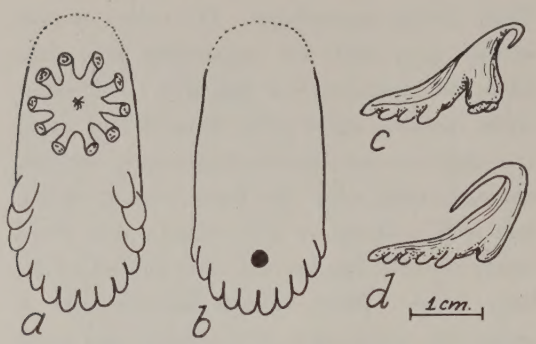


Fig. 2. *Peniagone lugubris*. *a—b*. Sketch (reconstructed) of the largest specimen seen from the ventral and dorsal sides respectively (the veil was so contracted that no idea of its appearance could be formed). *c—d*. Sketches of two of the other specimens in their present state.

tween the tentacle crown and the papillae there is a distinct diastema. In the smaller specimens there are, apparently, fewer papillae, but their number cannot be made out exactly owing to the poor state of the specimens. There is a well developed veil, especially conspicuous in some of the smaller specimens. In one of the specimens it is of the same length as the main body (Fig. 2 *d*). In this specimen the anterior half of the veil is bent backwards, whereas in another specimen it is bent downwards. ... parently the veil is very flexible and capa... of considerable extension and contraction. ... the largest specimen it is much contract... One of the fragments seems to show that ... veil is divided into four lobes anteriorly. ... another fragment the number of lobes s... to be larger, but perhaps this veil has b... torn.

All the specimens are now, in alcohol, ... deep violet, almost black colour. When a... they were reddish violet.

The most common sclerites of the b... wall (Fig. 3 *a*) are those of the type cha... teristic of the Peniagoninae (by EKMAN, 1... designated »Vierfüsse»), viz. the primary ... with four arms bent inwards and each ... with an outwardly directed projection. T... arms are very distinctly bent inwards, a... 0.07 mm long and finely spinous in ... than half their outer part. The projec... are a little more spinous and measure a... half the length of the arms or somewhat ... Similar 'Vierfüsse', however often slightly ... gularly developed, are to be found in ...

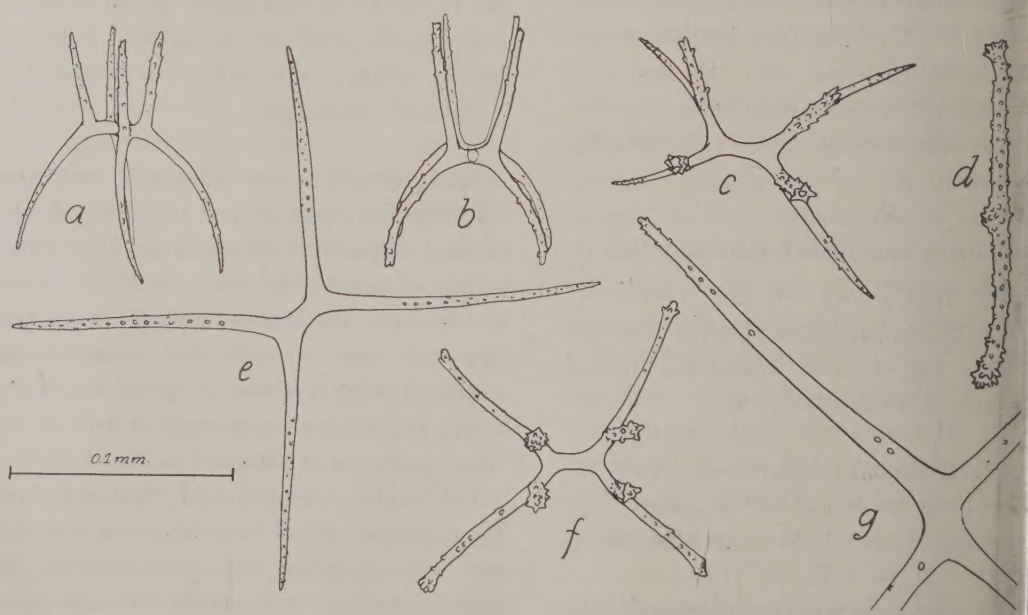


Fig. 3. *Peniagone lugubris*. *a—c, f*. 'Vierfüsse', *a* from the posterior dorsal body wall, *b* from a lateral papill... from the end), *c* from the ventral body wall (seen obliquely from above), and *f* a slightly abnormal one from a ... papilla (the arms only very slightly bent inwards). *d*. Rod from the gullet. *e, g*. Primary crosses from a lateral

llae, the veil, and the tentacles (Fig. 3 *b*, *f*). these places there are further scattered ary crosses (Fig. 3. *e*, *g*) with straight more or less spinous arms, and often a primary rod so short that they become y cross-shaped. Their diameter varies from t 0.2 to 0.4 mm; in the tentacles, where are rather irregularly developed, they even be about 0.5 mm in length, or tly more. In the tentacles there are in tion larger, smooth rods, straight or more ss curved. Spinous rods, about 0.15 mm , occur in the gullet (Fig. 3 *d*).

ne species, *P. lugubris*, to which these imens are referred, was described by THÉEL 2) on a specimen collected by the Chall- r at a depth of 4,570 m in a locality quite that recorded above. Hitherto only the -specimen was known. THÉEL's descrip- is not very exhaustive, his specimen g in a rather bad state of preservation. description of the sclerites agrees well with e of the present specimens, but, on the r hand, it is written in such general terms it would agree with not a few species of *agone*. THÉEL does not give any figures ne sclerites, but refers only to those of the ites of his *P. wyvillei* which they are said esemble. The illustration given of the ral appearance of the type-specimen agrees y well with that of the present specimens; ny rate it does not preclude the identity he present material with *lugubris*. What cially supports the conviction that these imens belong to *lugubris* is the colour, h in the type of *lugubris* was also dark t, almost black, when the specimen was in alcohol.

istribution: *Peniagone lugubris* is known with certainty from the type- ity in 2° 25' N, 20° 01' W, and the locality ded above, situated somewhat more to north in the mid-Atlantic. The depths 4,570 and 5,610—5,600 m respectively.

To *P. lugubris* may further belong, however, the fragment recorded below from the West Indies, 5,850—5,860 m.

Attention should also be called to *Peniagone ferruginea* of GRIEG (1921 pp. 7—8, text-fig. 3, pl. 1 4—6) from the vicinity of the Canaries, 2,800—3,000 m, which species at any rate stands very close to *lugubris*, the only difference from the descriptions being that *ferruginea* has the hindmost pair of papillae distinctly smaller than the other ones, whereas in *lugubris* the papillae are all of about the same size.

Peniagone sp. (? *lugubris* Théel)

Material: St. 371 (Haul No. 10) N 24° 12' W 63° 23' — N 24° 28' W 63° 18', Aug. 20th 1948; depth 5,850—5,860 m: One fragment.

This fragment, the tentacle-crown and part of the body-wall of a *Peniagone*, cannot be identified with certainty. The sclerites, however, resemble those of the above specimens referred to *P. lugubris*. The dark, greyish blue colour of the fragment also seems to support this identification.

Peniagone porcellus R. Perrier 1902

Fig. 4.

R. PERRIER 1896 p. 901; 1900 p. 118; 1902 pp. 426—429, pls. 13 7—9, 19 15—23.

Material: St. 363 (Haul No. 8) N 12° 22' W 52° 00' — N 12° 13' W 51° 44', Aug. 3rd 1948; depth 5,044—5,033 m: 1 specimen.

The only specimen present is in a very poor state, much torn and very slimy. It may have measured about 7—8 cm in length, but it is not possible to say anything definite about its general appearance when alive. No papillae could be discerned. The body wall is

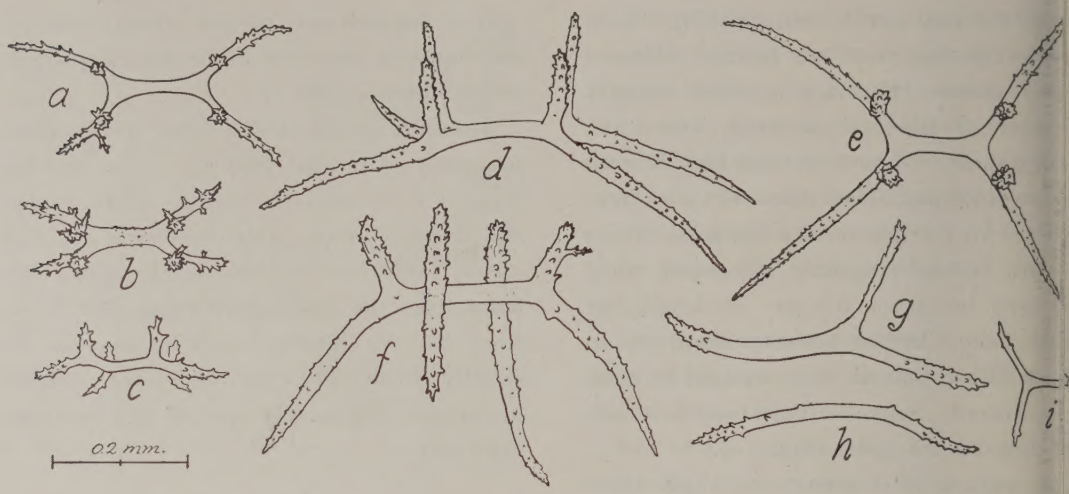


Fig. 4. *Peniagone porcellus*. *a—c*. 'Vierfüsse' from the anterior part of the ventral body wall. *d—f*. 'Vierfüsse' the anterior part of the dorsal body wall. *g—i*. Rods from the tentacles.

translucent; the colour very light pink. The foremost empty part of the intestine is reddish and easily seen through the body wall. The rest of the intestine preserved is filled with mud and is therefore of a grey colour.

The sclerites of the body wall are exclusively 'Vierfüsse', which in this species are fairly large and with a rather long primary rod. Those of the dorsal body wall (Fig. 4 *d—f*) measure about 0.5 to 0.6 (0.7) mm in length. Their arms are about twice as long as the primary rod and provided with short spines in their whole length and bent only moderately inwards. Their projections are fairly stout, of a length about that of the primary rod or somewhat less and more thorny than the arms; often they end rather bluntly. The 'Vierfüsse' of the ventral body wall (Fig. 4 *a—c*) are of a more delicate, but at the same time more thorny appearance and somewhat smaller, 0.25—0.45 mm long, than the dorsal ones. This, however, is due to the fact that the arms are only about as long as the primary rod which is itself of almost the same length as in the dorsal sclerites. The arms are only bent very little inwards. Their projections are short and, like the arms proper, provided with fairly longe spines. There are also some sclerites in which the primary rod too is vided with some small spines. In the tenta there are, besides the usual 'Vierfüsse', simple, pointed rods, straight or curved, various intermediate stages between these the 'Vierfüsse'. (Fig. 4 *g—i*).

This specimen, despite its poor condi can with certainty be referred to R. Perri *P. porcellus*, hitherto only known in the t specimen. The sizes of the dorsal and ve 'Vierfüsse' respectively correspond to t recorded by Perrier; and the appearan the dorsal ones is exactly as shown for type-specimen, (R. Perrier 1902 pl. 19 15– But when Perrier says of the sclerites 'ils sont à peu près identiques sur la dorsale et sur la face ventrale' I do not t he does enough justice to the difference ally present, which it has therefore been sidered worth while to illustrate by the companying figures.

Distribution: Only known from type-locality between the Azores and Eu 42° 19′ N, 23° 36′ W, 4,060 m, and the a recorded locality in the Western Atl somewhat east of Trinidad, at 5,044—5,0 depth.

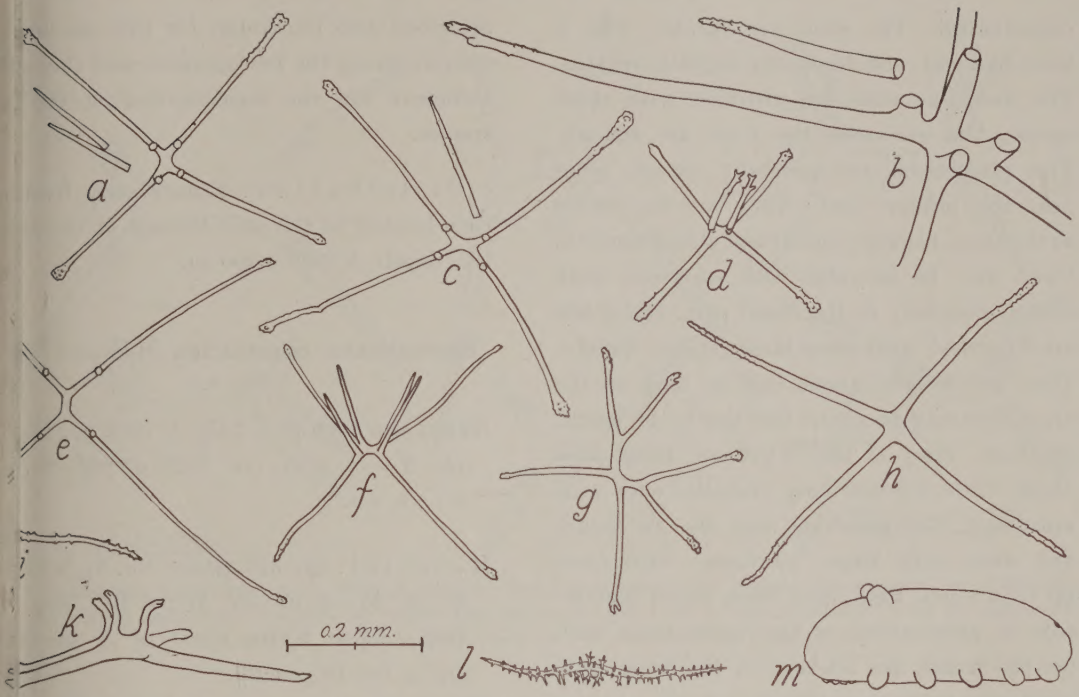


Fig. 5. *Peniagone nybelini*, type-specimen. *a—b*. 'Vierfüsse' from the dorsal body wall, *a* of the usual type. *c—i*. Sclerites from the ventral body wall. *c* the usual type of 'Vierfuss'. *d* abnormal 'Vierfuss' with only two projections. *e* abnormally slender 'Vierfuss' with the projections placed unusually far out on the arms. *g—h*. Primary crosses, *h* the usual type. *i*. Rod from the ventral body wall. *k*. 'Vierfuss' from the tentacles. *l*. Pointed rod from the gonads. *m*. Sketch showing the probable appearance of the specimen when alive.

Peniagone nybelini n. sp.

Fig. 5.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′ — N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

Diagnosis: *Peniagone* with five (or six) evenly distributed lateral papillae on either side and a pair of dorsal papillae anteriorly. 'Vierfüsse' of body wall almost cross-shaped, usually about 0.6 mm in diameter, their arms bent only slightly inwards, and smooth apart from the knob-like ends; their projections about half to a third of the length of the arms, usually pointed and almost smooth.

Type-locality: The mid-Atlantic near the Equator, 5,250—5,300 m.

Type preserved in the Natural History Museum of Göteborg.

The single specimen collected measures about 5 cm in length. Its colour is light reddish violet, mottled. It seems to be much contracted. Its present shape is ovoid. The papillae are difficult to observe on the outside of the body since they are completely retracted. From the inside of the body wall, however, it could be easily ascertained that there is a pair of dorsal papillae anteriorly, and five evenly spaced lateral papillae along one (the left) side, and along the other side six lateral papillae of which, however, the anterior two are, apparently, an abnormal duplication of a single papilla. There are ten tentacles and one polian vesicle. The specimen was ruptured ventrally, the intestine for the greater part missing, and the whole body-cavity filled with mud. Loose in this mud lay two clusters of now distinctly violet gonads.

The most common sclerites of the body wall are 'Vierfüsse' of a very characteristic appearance (Fig. 5 *a—f*). The primary rod is very short so that the sclerite becomes almost

cross-shaped. The arms are slender, with a knob-like end, and bent only slightly inwards. The knob-like ends are provided with small spines, but otherwise the arms are smooth. The projections are generally placed quite near the primary rod. They are as slender as the arms, usually pointed and almost smooth. Some may be provided with scattered small spines, especially in the distal part, and a few are furnished with some larger spines distally. They are usually about half as long as the arms, but may be about two thirds the length of these. Most of the 'Vierfüsse' have arms about 0.25—0.3 mm long. Smaller ones with arms only 0.15 mm long may also be found; and some very large 'Vierfüsse', with arms up to 0.8 mm long, have been found scatteredly in preparations of the dorsal body wall. On the whole, the sclerites of the dorsal side seem to be larger than the ventral ones. Among the usual 'Vierfüsse' there may also be some with only three, or two, projections; and one sclerite with only a single central projection has been observed. Usually the projections stand rather close to each other, but in some few sclerites they may be placed a small distance out on the arms (Fig. 5 *e*).

Besides the usual 'Vierfüsse' a number of slightly larger primary crosses (Fig. 5 *h*) are also present in the body wall, and further some few similar ones with only three arms and some with as many as six arms. In addition some small, thorny rods (Fig. 5 *i*) occur scatteredly.

The sclerites of the tentacles are essentially of the same type as the 'Vierfüsse' of the body wall, only more or less abnormally developed (Fig. 5 *k*).

The sclerites of the gonads are slender pointed rods, straight or curved, provided with numerous rather long spines of which some of the median ones may bear smaller thorns. The largest of these rods measure about 1 mm in length. Many of them are branched.

As far as I know the type of 'Vierfüsse' described and illustrated for this specime unique among the Peniagoninae and thus a sufficient for the identification of the species.

Distribution: Known only from type-locality in the mid-Atlantic at the E tor, depth: 5,250—5,300 m.

Scotoanassa translucida Hérouard 1

Fig. 6.

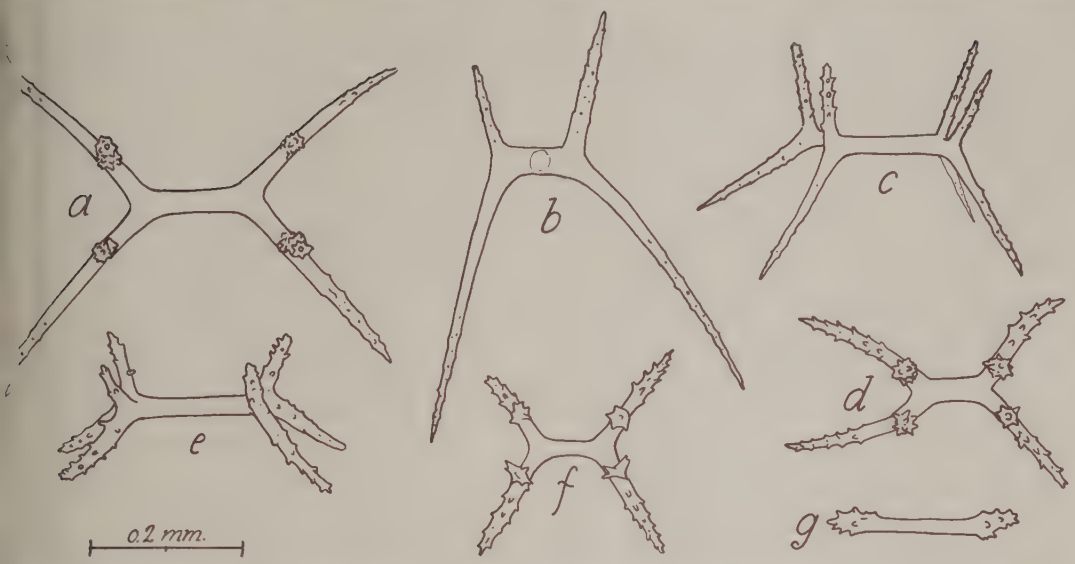
Hérouard 1899 p. 172 fig. 3; 1902 pp. 43 pls. 3 4—6, 6 17—20; 1923 pp. 88—90, 3 7—8, 4 4.

Material: St. 329 (Haul No. 3), N 09 W 26° 20′—N 09° 50′ W 26° 30′, July 1948; depth 5,610—5,600 m: 7 speci and a few fragments.

St. 401 (Haul No. 14), N 43° 40′ W 18 —N 43° 24′ W 18° 59′, Sept. 15th depth 5,000—5,025 m: 1 specimen (frag tary).

The two largest specimens measure a 70 mm in length and about 35—40 m breadth. The smallest specimens are a 40 mm long and 12—15 mm broad (specimens are much contracted). The specimens are intermediate, the third la being 50 mm long by 25 mm broad. fragmentary specimen from Haul 14 is 2 broad and was probably about 50 mm little more in length.

The specimens, when not too much tracted, are extremely flattened. One o largest has the posterior papillae (fou either side) well expanded, but in the ones they are contracted and often dif to discern. The anterior part of the extends somewhat over the tentacle-c and in one specimen four anterior pa can be distinguished, corresponding to th distinct papillae of the living specimen rated in Hérouard's pl. 3 4 (1923).



6. *Scotoanassa translucida*. *a—b*. Sclerites from the dorsal body wall of the 70-mm-large specimen. *c—f*. Sclerites the ventral body wall, *c—d* from the 70-mm-large specimen, *e* from one of the fragments, *f* from the midventral part of the 45-mm-large specimen. *g*. Rod from the gullet.

he colour is whitish and transparent, the erior part of the intestine often shining red ugh the body wall, as was the case in the g specimen illustrated by HÉROUARD. In fragment from Haul 14 it is, however, red oesophageal part of the intestine which es through.

nly one type of sclerites, the 'Vierfuss', rs in the body wall. The sclerites of the al side (Fig. 6 *a—b*) are rather slender, generally with arms 0.3—0.4 mm long. largest ones, however, have arms about mm long and measure almost 1 mm in l length (the distance between two arm- on the same side). The arms are modera- spinous in their distal half. The projections about half the length of the arms and throughout their length somewhat more ous than these. The sclerites in the lateral ts of the ventral side resemble the dorsal s but change gradually towards the mid- tral part of the body, where they are ller, i. e. with much shorter arms than dorsal sclerites, more spinous, and with short projections (Fig. 6 *f*).

The sclerites in the tentacles and the oesophageal part of the intestine are about 0.2—0.3 mm long, simple rods, smooth apart from the somewhat swollen ends (Fig. 6 *g*).

Distribution: *Scotoanassa translucida* was known previously from a number of localities between the Azores and Europe, at depths from 4,200 m (or less, 0—4,200 m) to 5,005 m. One of the above recorded localities is in the same area, whereas the other one is in the mid-Atlantic between West Africa and Brazil, at a depth of 5,610—5,600 m. The species is undoubtedly distributed throughout the Atlantic deep-sea.

Peniagone (or **Scotoanassa**) sp.

Fig. 7.

Material: St. 370 (Haul No. 9), N 19° 49′ W 65° 01′—N 19° 42′ W 64° 44′, Aug. 17th—18th 1948; depth 7,900—7,625 m: About 20 specimens.

These specimens, together with some more which, however, were not preserved, were found in the meshes of the trawl when it came

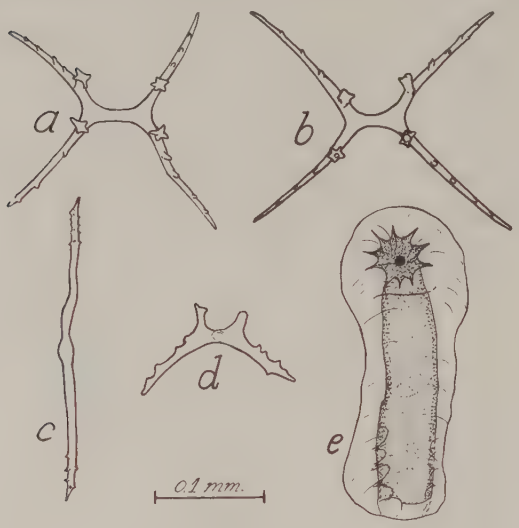


Fig. 7. Juvenile Peniagonid, Sw. Deep-Sea Exp. St. 370. *a—b, d.* 'Vierfüsse' from the ventral body wall. *c.* Rod from the gullet. *e.* Sketch of a specimen.

up at this station from the greatest depth at which zoological collections had hitherto been made. They are juvenile specimens of one or other species probably of the genus *Peniagone*, though their sclerites may also agree with the genus *Scotoanassa*. It is probable that they represent a new species, which I shall, however, refrain from naming owing to the uncertainty, and the impossibility of giving a satisfactory description.

The shape of these juvenile specimens is oblong cylindrical, with the anterior end somewhat swollen and the mouth placed ventrally. Their length varies from about 15 mm to 18 mm. The body wall of most of the specimens is thick and gelatinous, apart from ventrally, with the intestine, the longitudinal muscles and the ten tentacles shining through. Developmental stages of sclerites ('Vierfüsse') (Fig. 7 *a—b*) occur scatteredly in the gelatinous mass. Some specimens are provided with densely crowded sclerites ventrally, and sclerites may also be fairly numerous in other parts of the body, especially posteriorly. Some specimens seem to show sclerites developing in large numbers both in the deeper and in the outer layer of the gelatinous body wall posteriorly, whereas in the anterior swollen p the body sclerites are only developed i outer layer. A few of the best deve sclerites are drawn in Fig. 7. In the oesop part of the intestine there are pointed (Fig. 7 *c*).

A rudiment of an anterior veil seems present in some of the specimens; and in of the best preserved ones a number (4 of lateral papillae could also be desc posteriorly on either side.

In spite of their gelatinous body wa specimens have a fairly robust appea This together with the fact that all of seem to have their intestines filled with b material indicates that they must have bottom-dwelling. The Swedish Deep-Se pedition has thus by the capture of this thurian extended the vertical range k for benthonic animals downwards by a two kilometres.

Benthodytes typica Théel 1882

Fig. 8.

B. typica Théel 1882 pp. 103—104, pls. 35 4, 38 5, 44 8.

B. typica ? Théel 1886 b p. 2.

B. typica ? v. Marenzeller 1893 p. 1

B. glutinosa R. Perrier 1896 p. 903; 19 462—465, pls. 13 5, 20 31.

B. glutinosa Koehler & Vaney 1905 I —74, pl. 12 10.

B. glutinosa H. L. Clark 1920 p. 141.

B. typica + *B. glutinosa* Grieg 1921 pp 11, text-fig. 8, pls. 13 5, 20 31.

B. typica Hérouard 1923 pp. 101—10 6 4.

B. typica Deichmann 1930 pp. 123—

B. typica Heding 1940 p. 368.

Material: St. 313 (Haul No. 1), N 2 W 17° 39′—N 30° 05′ W 17° 18′, June 1948; depth 4,267—4,255 m: 3 specin St. 357 (Haul No. 6), N 02° 26′ W 2 —N 02° 24′ W 39° 12′, July 26th

)48; depth 4,474—4,430 m: 1 specimen.
St. 387 (Haul No. 13), N 40° 33′ W 35° 24′
N 40° 34′ W 35° 52′, Sept. 7th 1948; depth
540—4,600 m: 1 specimen.

nese specimens in their present state range
ı 44 to 67 mm in length by a breadth of
ı 9 to 20 mm, but are all extremely contrac-
with the longitudinal muscles squeezed
ther. They are, moreover, much torn. The
r layer of the skin of the dorsal side is for
greater part rubbed off; only the largest
imen (from Haul 13) was sufficient preser-
for three very minute papillae to be
erned anteriorly, rather close together to
right side of the midline. In their general
arance the specimens differ much from
type of *B. typica* shown in THÉEL's pl. 27 7,
the difference is easily explained by their
contracted state.

he species *B. glutinosa* was described by
PERRIER on contracted specimens similar
he present ones, the identity of *glutinosa*
typica pointed out by HÉROUARD op. cit.
specimens which THÉEL (1886 b) and
MARENZELLER (1893), with quieries, refer
typica were possibly also such contracted
imens; so, at any rate, were two of THÉEL's
imens which I have been able to re-examine.
ould seem as if the type of *B. typica* is the
hitherto known specimen preserved in a
y normal condition.

lerites, rods, are fairly numerous in the
llae both on the ventral and the dorsal
s, but very scattered in the body wall it-
A characteristic feature in most of the
is the slightly thickened middle. The
rites of the gonads are almost like those of
body wall and papillae, only generally
e slender and thorny, and often irregularly
ed.

he number of tentacles seems to vary from
o 18.

istribution: The collecting of
thodytes typica on no less than three of the

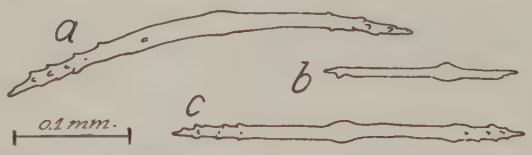


Fig. 8. *Benthodytes typica*. *a—b*. Rods from a ventral pedicel. *c*. Rod from the dorsal body wall near the base of a papilla.

trawlings of the Swedish Deep-sea Expedition is well in accordance with the fact that this species seems to be one of the most common and widely distributed deep-sea holothurians. It was recorded previously from about twenty localities in the Atlantic, viz. the West Indies, the mid-Atlantic, S. W. of Ireland, and off West Africa from Spain to Cap Blanco, depths 1,993 to 3,886 m, from four localities in the Indian Ocean, viz. the Arabian Sea and the Bay of Bengal, 2,754 to 3,652 m, and from one locality in the Eastern Pacific, 5° S, 88° W, 3,667 m (CLARK op. cit.). The new finds recorded above, between Europe and the Azores, east of the Azores, and north of Brazil, show that the species has a vertical range extending from 1,993 m a least down to about 4,600 m.

Euphronides kerhervei (Hérouard 1902)

Fig. 9.

Psychropotes kerhervei HÉROUARD 1902 pp. 27—30, pl. 4 1—9; 1923 p. 104, pl. 3 4—5.
Benthodytes kerhervei DEICHMANN 1930 pp. 125—126.
Euphronides kerhervei DEICHMANN 1940 pp. 202—203, pl. 35 9—12.

Material: St. 329 (Haul No. 3), N 09° 38′ W 26° 20′—N 09° 50′ W 26° 30′, July 3rd 1948; depth 5,610—5,600 m: 1 specimen.

St. 342 (Haul No. 4), N 01° 03′ W 18° 40′—N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

St. 357 (Haul No. 6), N 02° 26′ W 39° 26′ — N 02° 24′ W 39° 12′, July 26th—27th 1948; depth 4,474—4,430 m: 3 specimens.

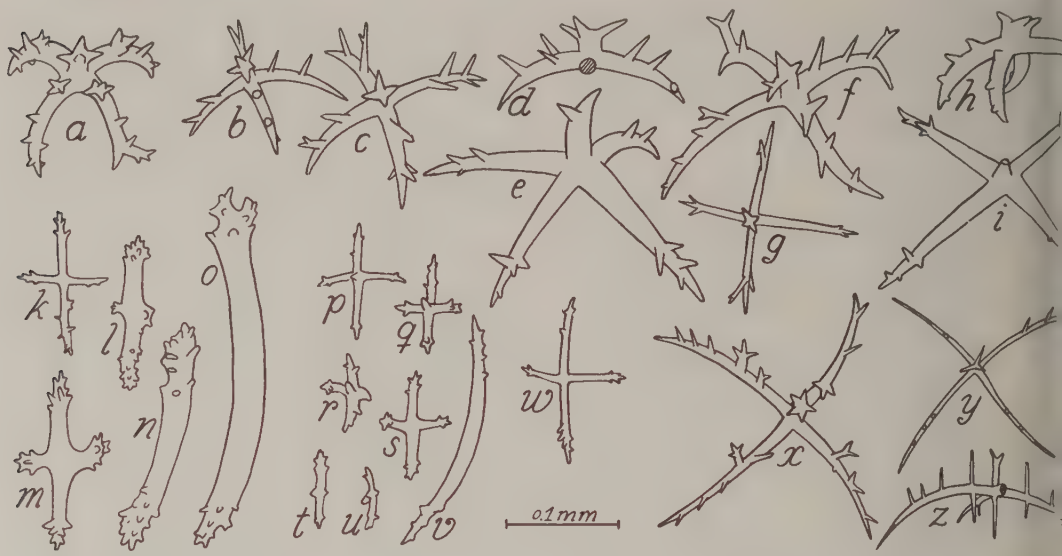


Fig. 9. *Euphronides kerhervei*. *a*—*i*. Sclerites from the dorsal body wall, *a* of the type-specimen, *b*—*g*. of the spe from Haul 3, *h*—*i* of a specimen from Haul 6 (in *i* the central projection is broken off). *k*—*w*. Sclerites from the l body wall, *k*—*o* from the type-specimen (*m* is the type of cross most commonly occurring), *p*—*v* from a spe from Haul 6, *w* the usual type of cross in the specimen from Haul 4. *x*—*z*. Sclerites from the gonads, *x* specimen from Haul 4, *y*—*z* of that from Haul 3.

The specimens at hand range from about 55 mm to about 100 mm in length. They are mostly rather distorted and damaged so that little can be said about their general appearance or appendages. The ventral surface is flattened, framed by the lateral papillae, and in some specimens has the appearance of a sole, whereas the dorsal side is vaulted, usually highest in the posterior part of the body.

The two largest specimens, 100 and 85 mm long, from Haul 4 and Haul 3 respectively, have ventrally about 25—30 pairs of pedicels, and three pairs of minute papillae on the anterior quarter of the dorsal side. The specimens from Haul 6, about 55 to 80 mm long, likewise seem to have had three pairs of dorsal papillae, but here arranged with one pair anteriorly, another pair about one third of the body length from the anterior end, and the third pair behind the middle of the body. None of these specimens, however, had all three pairs of papillae discernible. The arrangement of the dorsal papillae thus differs somewhat in the specimens from the eastern and the western Atlantic respectively. The arrangemer the papillae (four pairs) in the specimen off the Canaries figured by HÉROUARD, pl. 3 4, however, agrees best with the con of the specimens at hand from the w Atlantic. The sclerite-armature is also tially the same in all the specimens. N portance can thus be attached to this ap difference.

The posterior dorsal appendages are letely retracted in the largest specim which only two holes for the inverted p appendages are present at a distance of one quarter of the length of the body fr posterior end. In the other specime appendages are more or less extended. specimen they seem to have a commo likewise extendable, and in an other on is, apparently, only a single broad u appendage. This latter specimen is, ho in a very poor condition.

The number of tentacles is usually I in one specimen only 15 could be disce

In their present preserved state

nens are dark violet; when alive they reddish violet or red.

e sclerites of the dorsal side are rather and robust crosses with a strong central y projection and arms bent distinctly ds and provided with a varying number rge spines (Fig. 9 *b—i*). — This kind of tes was the only one mentioned by HÉRD.[1]) — Ventrally the sclerites are smallosses without central projection and with ght arms; and scattered among these there larger robust and usually slightly curved with the distal parts provided with coarse s, but otherwise smooth (Fig. 9 *k—w*). sclerites of the gonads are crosses which the dorsal ones, but are somewhat larger, more slender, and besides the usual s and projections often also have some are directed inwards (Fig. 9 *x—z*).

e tentacles are provided with crosses and like those of the ventral body wall.

ere is a fairly great variation in the sclerin each preparation, and both three- and rmed sclerites may be found among the l ones. There is also some difference bewn the sclerites of various specimens. The lites of the two specimens from Haul 3 4 (those with three anterior pairs of dorapillae) would thus seem to be generally slender than those of the specimens from 6 and of the examined type.

istribution: *Euphronides kerhervei* hitherto known from two localities west of Azores, depth: 5,005 m (type-locality) and m, one locality off the Canaries, 3,825 m, two localities in the West Indies, 1,143 4,345 m respectively. To these are added above-recorded three localities in the cal mid-Atlantic. The species is thus no doubt distributed throughout the Atlantic deep-sea. Vertical range: 1,143 m to about 5,600 m.

[1]) Through the kind assistance of Dr. CHERBONNIER of atural History Museum of Paris I have been able to take a reexamination of the sclerites in one of EDARD's original specimens and thus could ascertain resence also of the other kind of sclerites described Otherwise I should not have been certain of the fication.

Psychropotes aff. minutus
(Koehler & Vaney 1905)
Fig. 10.

P. minutus KOEHLER & VANEY 1905 pp. 76—78, pls. 8 4—5, 12 23—24.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′—N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m: 1 specimen.

St. 363 (Haul No. 8), N 12° 22′ W 52° 00′ —N 12° 13′ W 51° 44′, Aug. 3rd 1948; depth 5,044—5,033 m: Only a cluster of detached gonads.

The only specimen present measures about 50 mm in length, but is in such a poor state

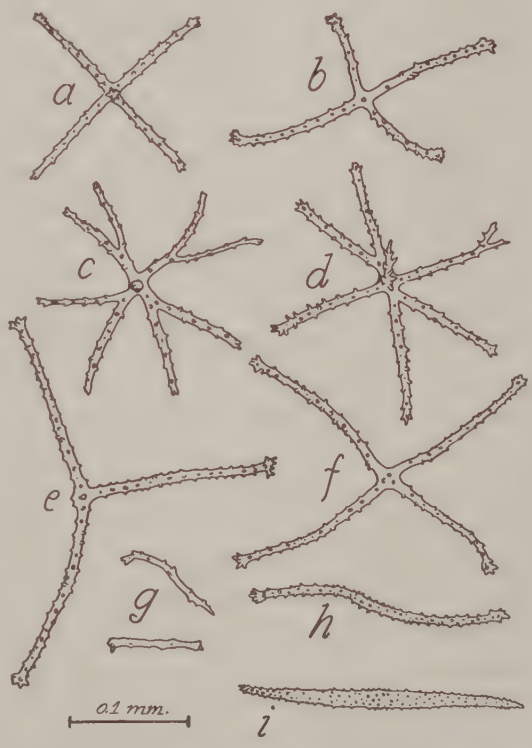


Fig. 10. *Psychropotes* aff. *minutus*. *a—d*. Sclerites from the anterior part of the dorsal body wall, *a—b* of the usual type. *e—f*. Two of the larger sclerites from the ventral body wall. *g*. Sclerites from the intestinal wall. *h*. Rod from the gullet. *i*. Pointed rod from the longitudinal muscles.

of preservation, ruptured and torn, that it is impossible to say anything definite of its appearance when alive. The number of tentacles may have been only eleven. There is no caudal appendage preserved, but a hole, about 3—4 mm in diameter, at the posterior end of the body shows that such an appendage may have been torn off. The colour of the specimen in its preserved state is dark violet; when alive it was bluish violet.

The sclerites of the body wall (Fig. 10 *a—f*) are spinous crosses, usually with the arms subequal and often with a central projection. They vary in diameter from about 0.15 to 0.4 mm. Many of the sclerites are only three-armed. In a preparation made of the body wall from the anterior dorsal side there were also several crosses with the arms bifurcated. In the longitudinal muscles there are spinous pointed rods, 0.2—0.3 mm long, (Fig. 10 *i*) and such rods occur also scatteredly in the mesenteries. Rods of a type (Fig. 10 *h*) recalling the crosses of the body wall occur in the gullet and similar ones are found in the tentacles. The sclerites of the gonads are like those of the body wall, but crosses with bifurcated arms are more common, and a greater number of them is provided with a central projection. Small irregular rods, about 0.1 mm long, (fig. 10 *g*) are present in the intestinal wall.

The fairly large cluster of detached gonads present from Haul 8 was violet with red eggs when alive, but in the preserved state the whole organ is uniformly violet. The eggs measure about 1 mm in diameter. The sclerites are exactly like those of the above described specimen, and the gonads therefore almost certainly belong to the same species.

The species represented here I believe to be the same as *Psychropotes minutus* described by KOEHLER & VANEY (1905) on a specimen from the Indian Ocean, measuring 65 mm in the length of the main body and with an appendage 55 mm long. At any rate the general appearance of the present spec when alive may have been the same as of the type shown by KOEHLER & VAN pl. 8 4—5. The description of the scl given by these authors, also applies i main to those of the present specimen, t it seems to indicate, as also do the figures in pl. 12 23—24, that the sclerites of the had fewer and larger spines. But, o other hand, the figures are so sketchy this apparent difference may not exi reality. *Psychropotes minutus*, at any is the only species described with whic present one can be compared; and I the prefer a reference of the above specim this species, though with a query, than erecting a new species whose va must be doubted.

The type of *P. minutus* was collected Laccadive Archipelago in 2,085 m. Th cimen discussed above is from the Tr mid-Atlantic, depth: 5,250—5,300 m, ar detached gonads from the West Atlantic, of Guiana, depth: 5,044—5,033 m.

Note: A number of foreign lobated masses wer along one of the lateral muscles in the body cavit specimen from Haul 4. They are not unlike an A racid of the genus *Dendrogaster*, but are attache body wall of the holothurian by means of a distinct stalk. The true nature of these supposed parasites however, to be cleared up.

General remarks

In their bathymetrical distribution thurians range from depths so shallow they are barely covered during ebb-ti the greatest depths explored, their known range, as set by the Swedish De Expedition, being almost 8,000 m. As we know they play a dominating rôle bottom-fauna of the abyss.

About 250 species of holothurians are from depths beyond the 1,000 m line, 175 from depths exceeding 2,000 m, a (somewhat more than 10 % of the recognized) are enumerated in the fo

s recorded from depths greater than m. Of these latter species 88 are recor- om depths exceeding 4,000 m, 26 from m or more, and a single one, the above oned, unfortunately unidentifiable, spe- *Peniagone*, from a depth of over 7,000 m —7,625 m). — The only other collectings to done at depths beyond 6,000 m did ield any holothurians.

ost half the species enumerated in the ave only been recorded from a single y, and many of the other species too own from a few localities only. A detai- iscussion of the zoogeographical compo- of the deep-sea fauna of holothurians ore does not seem to be opportune at t, and, consequently, I shall only make general remarks.

A number of deep-sea holothurians have recorded from the main Pacific as well m the main Atlantic. This applies e. g. *byssicucumis abyssorum* Théel; but re- CHERBONNIER showed that three distinct es have been mixed up under this name, 1) *A. abyssorum* s. str., occurring not in the main Atlantic, but also in the tretic of the Indian Ocean and the Pacific, *albatrossi* Cherbonnier, occurring in the rn Tropical Pacific, and 3) *A. ingolfi* mann, occurring in the Davis Strait, off Azores, and perhaps also in the North ic, off Japan, (*Cucumaria sluiteri* Ohshima). *nkyra abyssicola* is another species which been recorded both from the Pacific and the Atlantic, but, as discussed above, y also in this case be due to the mixing f two different, though closely related, s. A third species recorded from widely buted localities, *Molpadia holothurioides* er) [= *musculus* Risso], may also com- more than one species, which, however, t be separated at present. But still other of the deep-sea species listed are led from the main Pacific as well as the main Atlantic (usually also the Indian Ocean), some of them being also known from the Antarctic. Three species are known from both the main Pacific and the main Indian Ocean, but not from the Atlantic. One species is known besides from the main Pacific also from the Antarctic of both the Indian and the Atlantic quadrant, and another species recorded from the Pacific and the Indian Ocean reach just into the South Atlantic, thus probably also occurring in the main Atlantic, which, incidentally, may apply to all of them. Two species known from the main Pacific are recorded also from the Antarctic of the Indian Quadrant. Two species are found in the Antarctic of all three ocean systems, but hitherto not in the main basin of any of them, and one species has been found in the Antarctic of both the Pacific and the Indian Ocean. Probably the antarctic species for the greater will prove to have a circumpolar distribution, some of them also extending into the main basin of circumpolar distribution, some of them also extending into the main basin of thr great oceans.

Altogether it appears from the summary given de that a substantial part of the deep-sea holothurians is cosmopolitan; this in spite of the fact that revisions have proved or indicated that some species have erroneously been considered to have such a worldwide distribution. Only four or maybe six species are common to the Atlantic and the Indian Ocean, but unknown from the Pacific, whereas three species were known from the Pacific and the Indian Ocean, but not from the Atlantic; and the known distribution of the deep-sea holothurians thus does not clearly support the supposition of a division of the deep-sea fauna into two main regions: an Atlanto-Indian region and a Pacific region, which was indicated by the distribution of the deep-sea Asteroidea and Ophiuroidea, as known at present.

Probably, some of the listed species will prove to be invalid if more material is procured for showing their intraspecific variation,

though, as far as I am able to judge, this will only apply to a few of them.

Eighteen of the holothurian species recorded from depths exceeding 3,000 m have been found also at depths of less than 1,000 m, and seven of these also in depths of less than 500 m—this, however, mostly in the Antarctic (or Arctic). Only three of the deep-sea species have been found in depths of 100 m or less, viz. *Molpadia holothurioides* at 35 m in the Antarctic, 140 m otherwise being the shallowest depth recorded (as mentioned above there may, however, be some doubt as to the homogeneity of the species), *Pseudostichopus mollis* at 100 m in the Antarctic, 245 m otherwise being the shallowest depth from which it is known, and *Elpidia glacialis* at 70 m in the Arctic, outside this zoogeographical area, however, never found in depths of less than about 2,000 m.

One of the six orders of holothurians recognized, the *Pelagothurioidea*, is pelagic. The animals of this order caught at the deep trawling stations therefore may not actually have been collected in the deep-sea, for which reason the Pelagothurioidea has been omitted from the list.

The other five holothurian orders are all represented in the deep-sea with a few or more species. The *Apoda* and the *Dendrochirota*, which otherwise are mainly littoral, each have four species reaching down below 3,000 m, all of them probably distinct deep-sea species, only *Abyssocucumis abyssorum* having been recorded from a depth of less than 800 m, viz. 385 m in the Antarctic. The *Molpadiidae* include seven species recorded from depths below 3,000 m, and comprise many species occurring in deeper water as also many from comparatively shallow depths.

The greater number of the deep-sea holothurians known from below 3,000 m belong, however, to the two orders: the Aspidochirota and the Elasipoda. The *Aspidochirota* is mainly represented by 27 species, all of them of the family Synallactidae which is a typical deep-sea group, whereas the two other families of the order mainly comprise littoral or sublittoral forms.

The *Elasipoda*, finally, is represented below 3,000 m with no less than 88 species (about two thirds of the species described in the order) and is that holothurian order which is most distinctly associated with the deep sea, only in the polar seas occurring also in comparatively shallow water.

Copenhagen, Dec. 1950.

SPECIES OF HOLOTHURIANS RECORDED FROM DEPTHS OF MORE THAN 3,000 M, WITH INFORMATION OF DISTRIBUTION.

(Synonyms in brackets).

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
APODA				
Synaptidae				
otankyra				
ia (Verrill)	Several localities 45° N to 16° S			1,715—4,990
sicola (Théel)]				
ca (Ludwig)			Eastern Pacific, off California to Peru.	870—4,755
Myriotrochidae				
riotrochus				
bius H. L. Clark			4°5 S, 88° W	3,665
teus H. L. Clark			4°5 S, 88° W	3,665
DENDROCHIROTA				
Cucumariidae				
oyssicucumis				
orum (Théel)	Off the Azores	About 46° S to 66° S	Off Chili	385—4,070
rossi (Cherbonnier)			Eastern Pacific, off California to Peru	1,585—5,690
fi (Deichmann)	Davis Strait; near the Azores		? Off Japan 870 m	2,700—3,230
iiteri (Ohshima)]				
psilothuria				
taculata (Ludwig)		Bay of Bengal; Arabian Sea; Zanzibar	Off Japan; East Indies; off Lower California to Ecuador	225—4,080
MOLPADONIA				
Gephyrothuriidae				
ephyrothuria				
ki Koehler & Vaney		7° N, 81° E		3,495
Caudiniidae				
edingia				
ans (Théel)	S of Iceland; off the NE coast of U. S. A.; Cape Verdes; Mediterranean	Bay of Bengal	37°5 S, 179°5 E [var. glabra (Théel)]	500—3,200
ata var. armata (Théel), mediterranea (Bald.-Bart.)]				
Molpadiidae				
raplectana				
yderma H. L. Clark			55° N, 170°5 W; off Peru	3,190—5,205
olpadia				
ybia H. L. Clark			Off Peru	5,205—5,870
a (Théel)	Davis Strait to Cape Verdes and West Indies			1,730—5,270
ulata (Hérouard), spiniferus (Heding)				

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depth in m
granulata (Ludwig)		Bay of Bengal	Off Guatemala to Ecuador	2,690 —4
holothurioides (Cuvier) [musculus Risso, mediterranea (Grube), violacea Studer, perrieri (Petit), hispanicum (Petit), danielsseni (Théel), spinosum (Ludwig), asaphus (Heding)][1]	Davis Strait to West India; off Portugal to the Cape Verdes; the Mediterranean	Arabian Sea; Bay of Bengal; Kerguelen	Off Japan; off California to Peru	35 —5
ASPIDOCHIROTA				
Synallactidae				
Bathyplotes				
profundens Koehler & Vaney		13° N, 91° E		3,00
Benthothuria				
valdiviae Heding		63° S, 58° E		4,63
Capheira				
sulcata Ludwig			Off Columbia to Peru	2,875— 3
Mesothuria				
candelabri Hérouard	45° N, 7° W; 40° N, 35° W			4,540— 7
expectans Perrier	44° N, 19 5 W			4,2
lactea (Théel) [thomsoni (Théel)]	Many localities from S of Iceland to 30° S	50° S, 123° E; East Indies	Off Japan; mid-Pacific; New Zealand	695— 1
maroccana Perrier	38° N to 20° N			1,000— 2
megapoda H. L. Clark			0° N, 117° W	4,2
multipes (Ludwig)		Near the Laccadives and Ceylon	East Indies; off Panama to Peru	725— 6
rugosa Hérouard	Cape Verdes; Azores; West Indies			1,600— 9
verrilli (Théel) [roulei (Koehler)][2]	Many localities, 45° N to 12° N			550— 5
Paelopatides				
atlantica Hérouard	38° N, 25°5 W			4,0
confundens Théel			Off California to Chili; (East Indies?)	1,570— 17 (450— 26
gigantea (Verrill) [agassizii Théel, grisea Perrier]	Several localities, 43° N to 2° N			1,100— 16
Paroriza				
prouhoi Hérouard	46° N, 6° W; 40° N, 20° W			4,360— 38

[1]) Molpadia holothurioides in the sense given here, in accordance with H. L. Clark and Deichmann, may c more forms which, however, at present can not be separated.

[2]) It should be noted that the deep-water species Mesothuria verrilli Théel has often been regarded as identic the shallow-water species M. intestinalis (Ascanius & Rathke), distributed in the North Atlantic inclusive of the No Sea and the Mediterranean at depths from about 18 to 1,000 m.

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Depths in m
eudostichopus				
icus Perrier	West Indies; 42° N, 23°5 W; 60° N, 54° W			2,920—3,230
lum Heding]				
ssus Hérouard	40° N, 20 5 W; 20 N. 75° W			2,995 –4,360
s Hérouard	38° N, 23° W			4,020
zelleri Hérouard	37 N, 21 W			4,400
Théel	65° S, 57° W	47° S, 38° E	Many localities off California to Peru	100—5,205
atus v. Marenzeller	62° N to 24° N, incl. the Mediterranean	13° N, 91° E		400—3,625
tatus var. plicatus Koehler & ey, ingolfi Heding]				
is Théel	Several localities, 46° N to 70° S	46° S to 65° S	35° N, 170° E; East Indies; off Chili	895—5,305
gerina Hérouard]				
nallactes				
na Ludwig			Off Columbia to Peru	2,420—4,085
us Koehler & Vaney		12° N, 89° E		3,195
s Koehler & Vaney		10° N, 91° E		3,520
soni Vaney	66 5 S, 40 5 W			4,435
masoni (Walsh)		Bay of Bengal	New Guinea	310—3,295
latus Sluiter]				
ELASIPODA				
Deimatidae				
ima				
icum Hérouard	40° N, 20° W; 29° N, 24° W			2,800—4,360
astosum Théel]				
Théel	West Indies; off Portugal	Arabian Sea; Bay of Bengal		1,050—3,365
um Théel		3° N, 134° E		3,658
atlanticum Hérouard]				
un Théel		36° N, 178° E; East Indies		880—3,750
cirophanta				
Ludwig			Off Columbia	3,240—3,335
ata Perrier	Between the Azores and the Bay of Biscay			4,060—5,005
nutabilis Théel]				
ilis Théel	46° N to 43° S	Some localities S of 45° S	E of Australia; scattered in the mid-Pacific; off Lower California to Chili	1,805—5,305
phnurgus				
piculatum H. L. Clark			8°5 S, 85°5 W	4,335
um Ludwig			Off Columbia to Peru	2,150—4,085
Laetmogonidae				
Laetmogone				
ethomsoni Théel	Eastern Atlantic, 50° N to 28° N	46° S, 48°5 E; 50° S, 123° E	East Indies; off Japan; off Chili	650—3,290
Elpidiidae (Elpidiinae)				
Ahlyonice				
oxa Théel			35°5 N, 157°5 E; 30° N, 116° E	1,610—4,205
urea H. L. Clark]				

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	Dep in
Ellipinion				
albida (Théel)	37° S, 19°5 E			3,4
mollis (Théel)		42°5 S, 134° E		4,7
papillosus (Théel)	36°5 S, 36° W			4,8
Elpidia				
glacialis Théel	Baffin Bay; Norwegian Sea; Kara Sea; Barents Sea; off Morocco	(? S of Australia, 4,755 m)		70 (4,7
Kolga				
hyalina Danielssen & Koren	Davis Strait; Norwegian Sea			1,880–
Periamma				
insignis (Théel)		62°5 S, 95°5 E		3,6
naresi (Théel)		50° S, 123° E		3,2
robusta (Théel)		54° S, 108°5 E		3,5
roseum Perrier	Between the Azores and the Bay of Biscay			4,060–
tetramerum H. L. Clark			Off Peru	5,8
Scotoplañes				
globosa (Théel)	40° S, 2°5 E	54° S, 108°5 E	33°5 S, 74°5 W	3,565
murrayi (Théel)		61° S, 80° E	Off Peru	2,305–
[? = globosa (Théel)]				
Elpidiidae (Peniagoninae)				
Parelpidia				
anamesa H. L. Clark			85° S, 85°5 W	4,3
cylindrica (Théel)			34° S, 74° W	4,0
elongata Théel			33°5 S, 74°5 W	3,9
verrucosa Théel			33°5 S, 74°5 W	3,9
Peniagone				
ambigua (Théel)		54° S, 108°5 E		3,5
atrox Théel		42°5 S, 134° E		4,
azorica v. Marenzeller	Eastern Atlantic, Iceland to the Azores			2,320
bispiculata H. L. Clark			1° N, 138° W	4,
challengeri Théel		50° S, 123° E		3,
expansa Koehler & Vaney		12° N, 86° E		3,
ferruginea Grieg	29° N, 24° W			2,800
foliacea (Hérouard)	37° N, 22°5 W			4
horrifer Théel		54° S, 108 5 E		3
intermedia Ludwig			Off Mexico to Peru	2,420
lugubris Théel	2°5 N, 20° W; 10° N, 26° W; (? 24° N, 63° W)			4,570
mossmani Vaney	69°5 S, 15° W			4
nybelini Jensenius Madsen	1° N, 18°5 W			5,250
obscura Koehler & Vaney		11° N, 85° E		3
obsoleta (Hérouard)	40° N, 20°5 W			4
pirei Vaney	66°5 S, 40°5 W			4

	The Atlantic Ocean	The Indian Ocean	The pacific Ocean	Depths in m
us Perrier	42° N, 23°5 W; 12° N, 52° W			4,060—5,040
ea (Théel)		54° S, 108°5 E; 46° S, 48°5 E		2,925—3,565
(Théel)			35°5 N, 157°5 E	4,205
venil) Jensenius Madsen	20° N, 65° W			7,900—7,625
Koehler & Vaney		12°5 N, 85° E		3,295
n Perrier	An undefined locality in the E. Atlantic	63° S, 58° E		4,635
esi (Théel)		62°5 S, 95°5 E		3,610
Vaney	69°5 S, 15° W			4,790
Théel		65° S, 80° E	East Indies; mid-Pacific off Panama to Ecuador	1,160—4,335
Ludwig]				
i Théel	35° N, 33° W		0°5 S, 151°5 W	2,700—4,435
toanassa				
na Théel		43° S, 134° E		4,755
cida Hérouard	Many localities between Europe and the Azores; tropical mid-Atlantic			4,000—5,610
Psychropotidae				
thodytes				
ola Théel			34° S, 74° W	4,070
Vaney	48° S, 10° W			3,185
hshima			46°5 N, 146° E	3,290
Ludwig			0°5 S, 87° W; 15° S, 98°5 W	2,420—3,435
a v. Marenzeller	Eastern Atlantic, Greenland to the Cape Verdes			2,250—4,700
ifera Théel			33° S to 38° S, 74° W to 94° W	2,745—4,070
era Théel			12° S, 145° E; 0°5 S, 151°5 W; 34° S, 78° W	2,515—4,435
Vaney	67°5 S, 30°5 W			4,570
is H. L. Clark			5° S, 85° W	4,085
olenta Théel	(Cape of Good Hope)	Cape of Good Hope; Arabian Sea; Bay of Bengal; S. of Australia	Japan; off California to Chili	770—5,205
na Théel			7°5 S, 152° W	5,030
Théel		62° S, 95° E; 54° S, 109° E; 50° S, 123° E	34° S, 74° W	3,290—4,070
Vaney	69°5 S, 15° W			4,790
Théel	Many localities, 50° N to 10° N	Arabian Sea; Bay of Bengal	5° S, 88° W	1,995—4,600
sa Perrier]				
hronides				
Hérouard	32° N, 43° W			3,465
ta Koehler & Vaney		12°5 N, 85° E		3,295

	The Atlantic Ocean	The Indian Ocean	The Pacific Ocean	De in
cornuta Verrill [auriculata Perrier]	Off N. E. coast of U. S. A.; off W. Africa, 35° N to 0°	.....	.....	1,915
dyscrita H. L. Clark	.....	.....	Off Peru	5,
kerhervei (Hérouard)	Near the Azores and the Canaries; West Indies	.....	.....	1,145
scotiae Vaney	62° S, 41° W	.....	.....	3,
verrucosa Ludwig	.....	.....	Tropical Eastern Pacific 138° W to 80° W	2,420
violacea Perrier [talismani Perrier]	Denmark Strait to the West Indies and the Canaries	.....	.....	955
Psycheotrephes				
exigua Théel	.....	.....	7°5 S, 152° W	5,
Psychropotes				
brucei Vaney	67°5 S, 36°5 W	.....	.....	4,
buglossa Perrier	Between the Azores and Europe and West Africa	.....	.....	2,210
dubiosa Ludwig	.....	.....	2°5 N, 84° W	3,
fucata Perrier	43° N, 22° W	.....	.....	4,
grimaldi Hérouard	38° N, 25°5 W	.....	.....	4,
laticauda Vaney	68° S, 36° W; 40° S, 3° E	.....	.....	4,570
longicauda Théel	71° S, 17° W	62° S, 96° E; 54° S, 109° E	34° S, 74° W	2,580
minutus Koehler & Vaney	Tropical mid-Atlantic	The Laccadives	.....	2,088
raripes Ludwig	.....	.....	47° N, 146° E; 104° W to 80° W, 1° N to 9° S	2,875
semperiana Théel	.6° N, 14° W; 36° S, 21° W	.....	.....	3,475

List of Literature

H. L. 1908. The Apodous Holothurians. Smithnian Contr. 35.
)13. Echinoderms from Lower California. Bull. ner. Mus. Nat. Hist. 32.
)20. Tropical Pacific Holothurioidea. Mem. Mus.)mp. Zool. 39.
)24. The Synaptinae. Bull. Mus. Comp. Zool. 65.
NIER, G. 1941. Deux Cucumaria Abyssaux: C.)yssorum Théel et. C. albatrossi n. sp. Bull. d. us. (2) 13.
)47. Une Holothurie abyssale: Abyssocucumis golfi (Deichmann). Bull. d. Mus. (2) 19.
NN, E. 1930. The Holothurians of the Western art of the Atlantic Ocean. Bull. Mus. Comp. Zool.
)40. Rep. on the Holothurians coll. by the Harvard-Havana Exp. Mem. Soc. Cubana. Hist. Nat.
S. 1925. Systematisch-phylogenetische Studien)er Elasipoden und Aspidochiroten. Zool. Jahrb.
)27. Holothurien. Deutsche Südpolarexp. 1901—3. Zool. 11.
. 1921. Echinodermata. Rep. Sci. Res. Michael rs Exp. 3.
RD, E. 1896. Note prlm. Holothuries d. Princsse Alice. Bull. Zool. Soc. France 21.
)02. Holothuries des Campagnes de la Princesse lice. Monaco Rep. 21.
)23. Holothuries de la Princesse Alice et l'Hirndelle. Monaco Rep. 66.
HEDING, S. & LUDWIG, H. 1835. Holothurien der Deutschen Tiefsee Exp. I. Valdivia Rep. 24.
HEDING, S. 1935. Holothurioidea I. Ingolf Exp. Rep. 4.
— — 1940. Holothurien der Deutschen Tiefsee Exp. II. Valdivia Rep. 24.
— — 1942. Holothurioidea II. Ingolf Exp. Rep. 4.
KOEHLER, R. & VANEY, C. 1905. Holothuries rec. par l'Investigator I. Ech. of the Indian Museum.
LUDWIG, H. 1894. The Holothurioidea. Rep. Exp. W. Coast of Mexico by Albatross. Mem. Mus. Comp. Zool. 17.
— — 1935, vide HEDING & LUDWIG.
OHSHIMA, H. 1915. Rep. Holothurians coll. by Albatross in the N. W. Pacific. Proc. U. S. Nat. Mus. 48.
PERRIER, R. 1902. Holothuries. Exp. sc. Travailleur et Talisman.
THÉEL, HJ. 1882. Holothurioidea I. Challenger Rep. 4.
— — 1886 a. Holothurioidea II. Challenger Rep. 14.
— — 1886 b. Holothurioidea, Blake. Bull. Mus. Comp. Zool. 13.
VANEY, C. 1905, vide KOEHLER & VANEY.
— — 1908. Holothuries d. l'Expd. Antarc. Nat. Ecossaise. Trans. Roy. Soc. Edinburgh 46.
VERRILL, A. E. 1885. Res. Exp. Albatross. Rep. Comm, Fish and Fisheries. 1883.

In addition I have had the opportunity of seeing an unpublished master's thesis, BENT HANSEN 1950: On the geographical distribution of the deep-sea holothurians in relation to their systematic position and the ecological factors. The manuscript, in Danish, is on file in the library of the Zoological Institute of Copenhagen.